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(54) **POWER MANAGEMENT SYSTEM THAT INCLUDES A GENERATOR CONTROLLER**

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G06G 7/635	(2006.01)
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H02J 7/14	(2006.01)

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USPC 700/286, 276, 287
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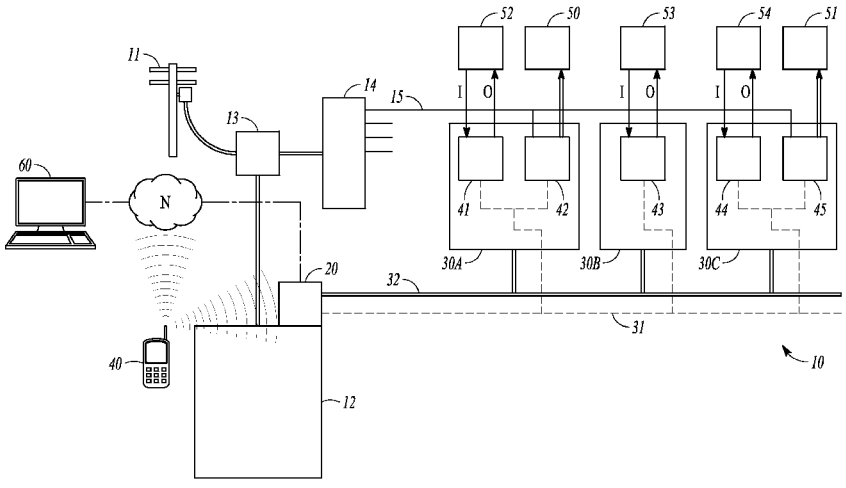
(57) **ABSTRACT**

Some embodiments relate to a power management system that includes an engine-driven generator and a plurality of load switching and sensor modules that are located remotely from the generator. The load switching and sensor modules include power switching devices and/or sensor circuits. In some embodiments, the power switching devices are operated to selectively provide protected power from a breaker to loads. The power management system further includes a generator controller that is mounted to the engine-driven generator. The generator controller is configured to operate the engine-driven generator and the sensor and load switching modules. The generator controller is further configured to receive input signals from the load switching and sensor modules via a databus, and provide commands to the load switching and sensor modules via the databus to operate the power switching devices and selectively provide power to loads.

15 Claims, 3 Drawing Sheets



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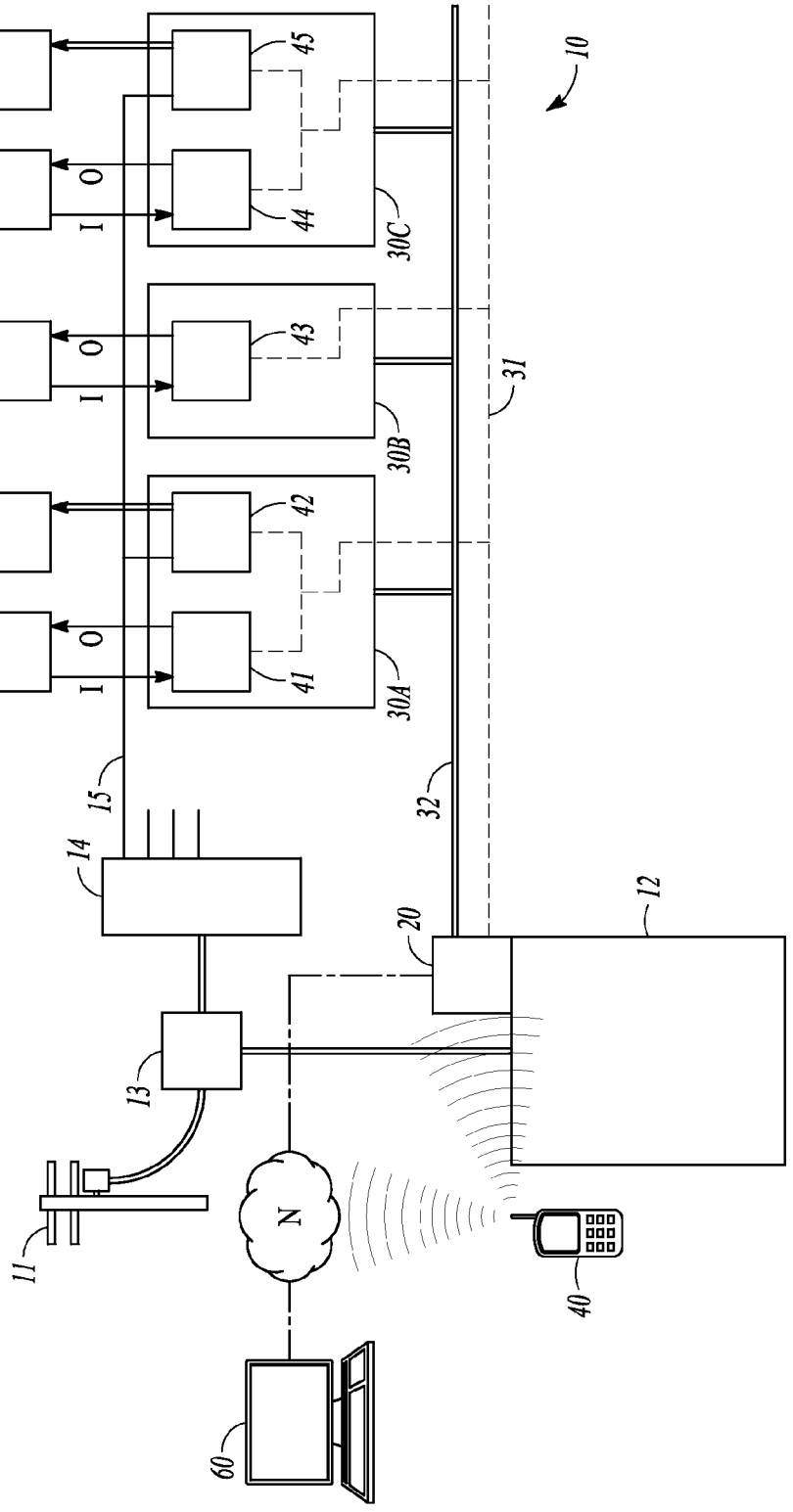
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11
12
13
14
15
20
30A
30B
30C
31
32
40
41
42
43
44
45
50
51
52
53
54
60
N
O
I

FIG. 1

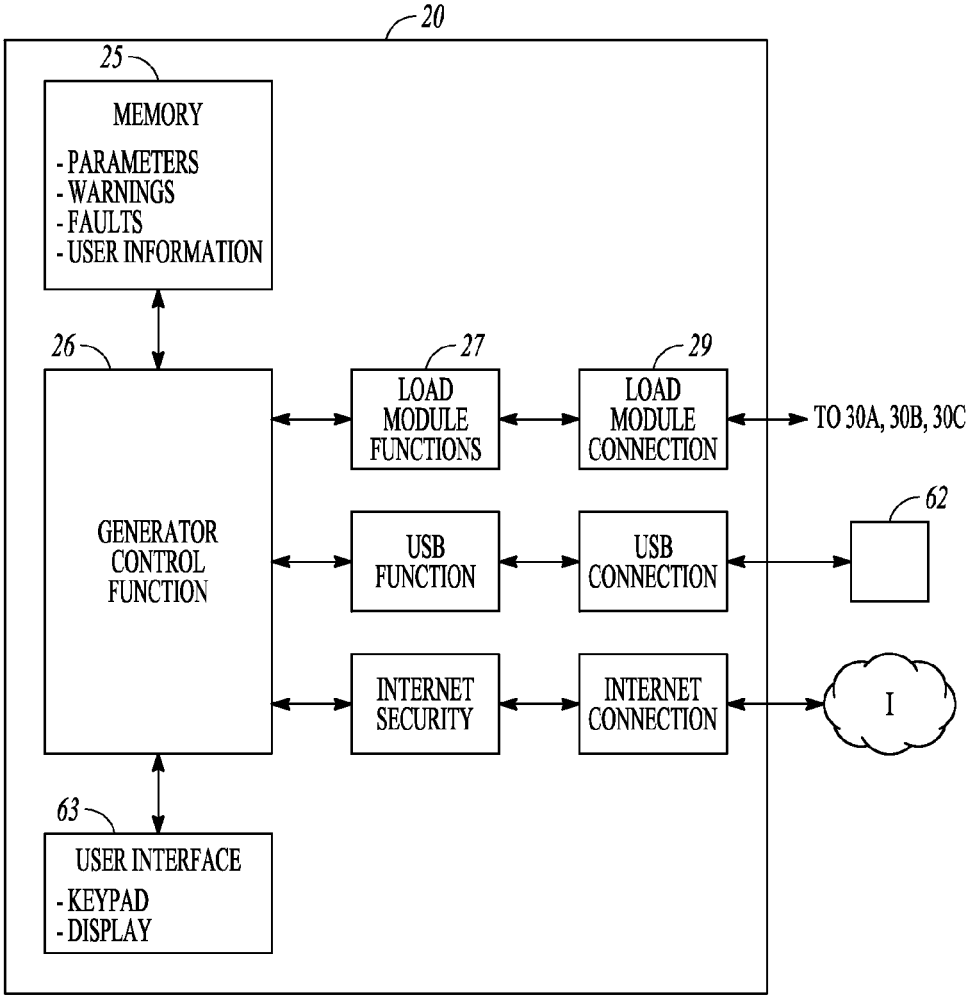
20
25
MEMORY
- PARAMETERS
- WARNINGS
- FAULTS
- USER INFORMATION
26
GENERATOR CONTROL FUNCTION
27
LOAD MODULE FUNCTIONS
29
LOAD MODULE CONNECTION
TO 30A, 30B, 30C
USB FUNCTION
USB CONNECTION
62
INTERNET SECURITY
INTERNET CONNECTION
I
63
USER INTERFACE
- KEYPAD
- DISPLAY

FIG. 2

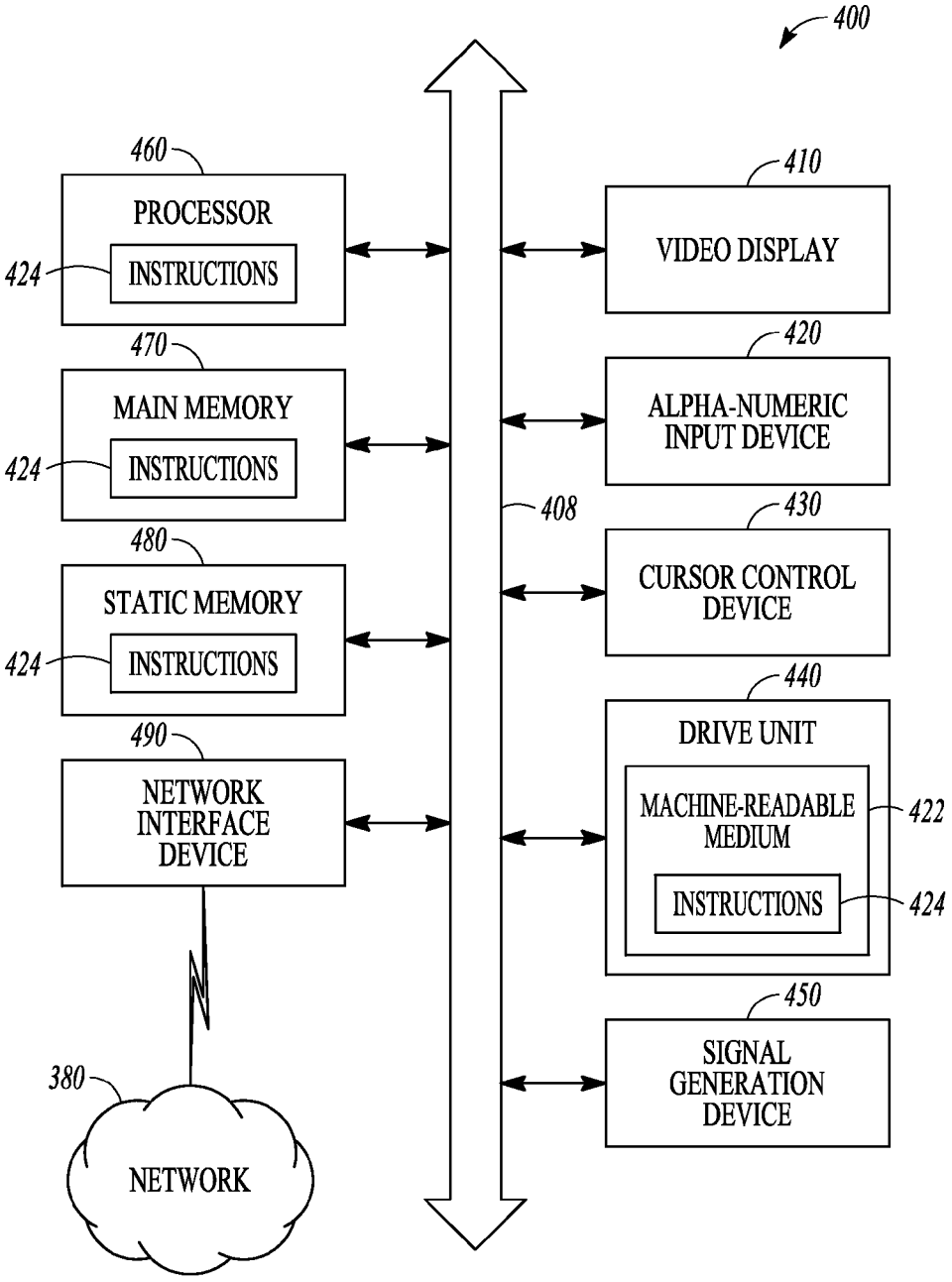
400
460
PROCESSOR
424
INSTRUCTIONS
470
MAIN MEMORY
424
INSTRUCTIONS
480
STATIC MEMORY
424
INSTRUCTIONS
490
NETWORK INTERFACE DEVICE
380
NETWORK
408
410
VIDEO DISPLAY
420
ALPHA-NUMERIC INPUT DEVICE
430
CURSOR CONTROL DEVICE
440
DRIVE UNIT
MACHINE-READABLE MEDIUM
422
INSTRUCTIONS
424
450
SIGNAL GENERATION DEVICE

FIG. 3

POWER MANAGEMENT SYSTEM THAT INCLUDES A GENERATOR CONTROLLER

TECHNICAL FIELD

Embodiments pertain to a power management system, and more particularly to a power management system that includes a generator controller.

BACKGROUND

Power management systems are used to selectively provide power to various types of power consuming loads. In addition, most conventional systems are able to collect sensor data relating to operation of the power consuming loads.

One of drawbacks with existing power management systems is that they typically require numerous relatively expensive programmable modules. These numerous relatively expensive programmable modules are required in order to adequately control the various power consuming loads as well as to collect the necessary sensor data in order to effectively manage the power consuming loads.

Therefore, a need exists for a power management system that is able to control various power consuming loads without using numerous relatively expensive programmable modules. In addition, the power management system should be able to collect sensor data in order to effectively manage the power consuming loads without using numerous relatively expensive programmable modules.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic view illustrating an example power management system that includes a generator controller.

FIG. **2** is a functional block diagram of the generator controller shown in FIG. **1**.

FIG. **3** is a block diagram that illustrates a diagrammatic representation of a machine in the example form of a computer system within which a set of instructions for causing the machine to perform any one or more of the methodologies discussed herein may be executed.

DETAILED DESCRIPTION

The following description and the drawings sufficiently illustrate specific embodiments to enable those skilled in the art to practice them. Other embodiments may incorporate structural, logical, electrical, process, and other changes. Portions and features of some embodiments may be included in, or substituted for, those of other embodiments. Embodiments set forth in the claims encompass all available equivalents of those claims.

FIG. **1** is a schematic view illustrating an example power management system **10**. The power management system **10** further includes an engine-driven generator **12** and a plurality of load switching and sensor modules **30**A, **30**B, **30**C that are located remotely from the generator **12**. The load switching and sensor modules **30**A, **30**B, **30**C include power switching devices **42**, **45** and/or sensor circuits **41**, **43**, **44**. In some embodiments, the power switching devices **42**, **45** are operated to selectively provide protected power from breaker panel **14** to loads **50**, **51** (e.g., through source bus **15**).

In the example embodiment shown in FIG. **1**, power switch device **42** provides power to load **50** and power switch device **45** provides power to load **51**. It should be noted that any type of power switching device that is known now, or discovered in the future, may be included in the example power management systems described herein. The type of power switching devices that are included in the power management system **10** will depend in part on cost and/or the application where the power management system **10** will be used.

In addition, sensor circuit **41** sends and receives signals I, O to/from sensor and signal output **52**; sensor circuit **43** sends and receives signals I, O to/from sensor and signal output **53**; and sensor circuit **44** sends and receives signals I, O to/from sensor and signal output **54**. As an example, one or more of the sensors **52**, **53**, **54** may be a temperature sensor, switch, security sensor, flammable gas sensor, smoke sensor, CO sensor, fuel level, motion sensor, time input, thermostat, moisture sensor, light level water level weather sensor or camera sensor. It should be noted that any type of sensor that is known now, or discovered in the future, may be included in the example power management systems described herein. The type of sensors that are included in the power management system **10** will depend in part on cost and/or the application where the power management system **10** will be used. As an example, one or more of the signal outputs may be a warning signal. It should be noted that any type of signal that is known now, or discovered in the future, may be included in the example power management systems described herein. The types of signals that are included in the power management system **10** will depend in part on cost and/or the application where the power management system **10** will be used.

The power management system **10** further includes a generator controller **20** that is mounted to the engine-driven generator **12**. The generator controller **20** is configured to operate the engine-driven generator **12** and the sensor and load switching modules **30**A, **30**B, **30**C. The generator controller **20** is further configured to receive input signals from the load switching and sensor modules **30**A, **30**B, **30**C via a databus **31**, and provide commands to the load switching and sensor modules **30**A, **30**B, **30**C via the databus **31** to operate the power switching devices **42**, **45** and selectively provide power to loads **50**, **51**.

In some embodiments, the generator controller **20** includes a power source (not shown) that supplies power to operate the load switching and sensor modules **30**A, **30**B, **30**C via a power bus **32**. As an example, the power source may be a 12V direct current power source, although it should be noted that other sources for powering the load switching and sensor modules **30**A, **30**B, **30**C are contemplated. In addition, the power source may be regulated by the generator controller **20**.

It should be noted that the generator controller **20** may regulate power to the load switching and sensor modules **30**A, **30**B, **30**C during startup and shut down. In addition, the loss of utility power **11** would not affect operation of the load switching and sensor modules **30**A, **30**B, **30**C.

In the illustrated example embodiment, each of the sensor circuits **41**, **43**, **44** includes a sensor input circuit that receives an input signal I from a respective sensor **52**, **53**, **54** for delivery to the generator controller **20** via the databus **31**. It should be noted that the sensor input circuit may convert the input signal I before sending the input signal to the generator controller **20**.

Each of the sensor circuits **41**, **43**, **44** may also include a signal output circuit that transmits an output signal O received from the generator controller **20** via the databus **31** to a respective sensor **52**, **53**, **54**. It should be noted that the sensor output circuit may convert the output signal O before sending the output signal to a respective sensor **52**, **53**, **54**. As examples, the output signal O may relate to a run alert warning, fault, home automation, security system, door lock system, thermostat, or gated access system.

In some embodiments, the generator controller **20** may be configured to exchange data with an external communication device. As an example, the generator controller **20** may be configured to receive commands from the external communication device to activate (or deactivate) one or more of the power switching devices **42**, **45** within one or more of the load switching and sensor modules **30**A, **30**B, **30**C. In addition, the generator controller **20** may be configured to deliver signals to the external communication device that are received from the sensors **41**, **43**, **44** through one or more of the load switching and sensor modules **30**A, **30**B, **30**C.

In the example embodiment illustrated in FIG. **1**, the generator controller may be configured to exchange data with a wireless device **40** through a network (e.g., the Internet N). It should be noted that other embodiments are contemplated where the generator controller **20** is configured to communicate directly with the wireless device (also shown in FIG. **1**).

As another example, the generator controller **20** is shown as being configured to exchange data with a personal computer **60** via a network. As yet another example, the generator controller **20** may be configured to send signals to and/or receive commands from an external device **62** (see FIG. **2**) that is connected to the generator controller **20** through a USB port.

As also shown in FIG. **2**, embodiments are contemplated where the generator controller **20** may be configured to receive signals at a user interface **63** and/or send commands from the user interface **63**. In some embodiments, the user interface **63** is mounted to the generator controller **20**. The user interface **63** may include a keyboard and/or a display that are configured to facilitate interaction with one or more of the load switching and sensor modules **30**A, **30**B, **30**C.

In some embodiments, the generator controller **20** may be configured to store data related to the operation of any sensors **52**, **53**, **54** and/or the power loads **50**, **51** that are included in the power management system **10**. In the example embodiment that is illustrated in FIG. **2**, the generator controller **20** stores and utilizes data relating to parameters, warning, faults and user information in memory **25**. As examples, the generator controller **20** may be configured to store data related to sensor input ranges and conversion factors.

In addition, the generator controller **20** may store and utilize data relating to (i) generator control functions **26** (e.g., start and stop); (ii) load switching and sensor module **30**A, **30**B, **30**C functions **27** (e.g., timers to activate the power switching devices **42**, **45**); and/or (iii) load switching and sensor module **30**A, **30**B, **30**C connections **29**.

FIG. **3** is a block diagram that illustrates a diagrammatic representation of a machine in the example form of a computer system **400** within which a set of instructions for causing the machine to perform any one or more of the methods discussed herein may be executed. As examples, the computer system **400** may execute any of the methods that are performed by any of the disclosed example generator controllers **20**, and/or disclosed example load switching and sensor modules **30**A, **30**B, **30**C.

In some embodiments, the computer system **400** may operate in the capacity of a server or a client machine in a server-client network environment, or as a peer machine in a peer-to-peer (or distributed) network environment.

The computer system **400** may be a server computer, a client computer, a personal computer (PC), a tablet PC, a set-top box (STB), a Personal Digital Assistant (PDA), a cellular telephone, a Web appliance, a network router, switch or bridge, or any machine capable of executing a set of instructions (sequential or otherwise) that specify actions to be taken by that machine. Further, while only a single machine is illustrated, the term "machine" shall also be taken to include any collection of machines that individually or jointly execute a set (or multiple sets) of instructions to perform any one or more of the methodologies discussed herein.

The example computer system **400** may include a processor **460** (e.g., a central processing unit (CPU), a graphics processing unit (GPU) or both), a main memory **470** (see also, e.g., memory **25** and generator control functions **26** in FIG. **2**) and a static memory **480**, all of which communicate with each other via a bus **408**. The computer system **400** may further include a video display unit **410** (e.g., liquid crystal displays (LCD) or cathode ray tube (CRT)). The computer system **400** also may include an alphanumeric input device **420** (e.g., a keyboard), a cursor control device **430** (e.g., a mouse), a disk drive unit **440**, a signal generation device **450** (e.g., a speaker), and a network interface device **490**.

The disk drive unit **440** may include a machine-readable medium **422** on which is stored one or more sets of instructions (e.g., software **424**) embodying any one or more of the methodologies or functions described herein. The software **424** may also reside, completely or at least partially, within the main memory **470**, memory **25** and/or within the processor **460** during execution thereof by the computer system **400**, the main memory **470** and the processor **460** also constituting machine-readable media. It should be noted that the software **424** may further be transmitted or received over a network (e.g., network **380** in FIG. **3**) via the network interface device **490**.

While the machine-readable medium **422** is shown in an example embodiment to be a single medium, the term "machine-readable medium" should be taken to include a single medium or multiple media (e.g., a centralized or distributed database, and/or associated caches and servers) that store the one or more sets of instructions. The term "machine-readable medium" shall also be taken to include any medium that is capable of storing, encoding or carrying a set of instructions for execution by the machine and that cause the machine to perform any one or more of example embodiments described herein. The term "machine-readable medium" shall accordingly be taken to include, but not be limited to, solid-state memories and optical and magnetic media.

The power management systems and methods described herein may permit control of various power consuming loads without using numerous relatively expensive programmable modules. In addition, the power management system may collect sensor data and provide output signals in order to effectively manage the power consuming loads without using numerous relatively expensive programmable modules.

The Abstract is provided to comply with 37 C.F.R. Section 1.72(b) requiring an abstract that will allow the reader to ascertain the nature and gist of the technical disclosure. It is submitted with the understanding that it will not be used to limit or interpret the scope or meaning of the claims. The following claims are hereby incorporated into the detailed description, with each claim standing on its own as a separate embodiment.

What is claimed is:

1. A power management system comprising:

an engine-driven generator;

a load switching and sensor module located remotely from the generator, the load switching and sensor module including a power switching device and a sensor circuit;

a databus; and

a generator controller mounted to the engine-driven generator, the generator controller configured to control the engine-driven generator and the power switching device in the load switching and sensor module, the generator

controller configured to receive input and output signals from the load switching and sensor module via the databus and provide commands via the databus to the load switching and sensor module in order to control the power switching device and selectively provide power to a particular load, wherein the generator controller includes a power source that is inside the generator controller and supplies power to operate the load switching and sensor module, wherein the load switching and sensor module is not connected to utility power such that the loss of utility power will not affect the operation of the load switching and sensor module;

wherein the sensor circuit includes a sensor input circuit that converts an input signal received from a sensor located remotely from the load switching and sensor module for delivery to the generator controller via the databus, and wherein the sensor circuit includes an output circuit that transmits an output signal received from the generator controller for transmission to the sensor, wherein the sensor includes at least one of a temperature sensor, security sensor, flammable gas sensor, smoke sensor, CO sensor, fuel level, motion sensor, time input, thermostat, moisture sensor, light level, water level, weather sensor or camera sensor, wherein the generator controller is configured to store data that is received from the load switching and sensor module related to the operation of the sensor and the particular load.

2. The power management system of claim **1**, wherein the power source is a 12V direct current power source.

3. The power management system of claim **1**, wherein the power source is regulated by the generator controller.

4. The power management system of claim **1**, wherein the output signal relates to a run alert warning, fault, home automation, security system, door lock system, thermostat, or gated access system.

5. The power management system of claim **1**, wherein the generator controller includes timers for activating the power switching device.

6. The power management system of claim **1**, wherein the power switching device is configured to selectively provide protected power to the load.

7. The power management system of claim **6**, wherein the load includes at least one of lighting, pump, fan, valve, horn, heating, defroster, refrigerator, freezer, pool, irrigation, gate, door, window covering, vent, camera recorder, vacuum, charger, fire lighter, smart appliance or cooling device.

8. The power management system of claim **1**, wherein the generator controller is configured to exchange data with an external communication device.

9. The power management system of claim **8**, wherein the generator controller is configured to receive commands from the external communication device to activate the power switching device.

10. The power management system of claim **8**, wherein the generator controller is configured to deliver signals to the external communication device from the sensor.

11. The power management system of claim **8**, wherein the generator controller is configured to exchange data with a wireless device.

12. The power management system of claim **8**, wherein the generator controller is configured to exchange data with a computer via a network.

13. The power management system of claim **8**, wherein the generator controller is configured to store data related to the operation of the sensor and the particular load.

14. The power management system of claim **13**, wherein the generator controller is configured to store data related to sensor input ranges and conversion factors.

15. The power management system of claim **1**, wherein the power source in the generator controller supplies power to the sensors and the power switching devices within the load switching and sensor module.

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